However, particularly in the case of rehabilitation, the conditions of use of the turbine may be modified, particularly by reduction of the speed of rotation and/or increase of the pressure head, in which case the orientation of the leading edge of the blades is no longer compatible with the angle of incidence of the jet of water. In that case, eddies and/or phenomena of cavitation are created in the proximity of the pressure side and suction side surfaces of the blades, this reducing the efficiency of the hydraulic machine and promoting the phenomena of wear and tear.

It is a particular object of the invention to overcome these drawbacks by proposing a novel Francis runner able to function satisfactorily under the new conditions of use defined.

In this spirit, the invention relates to a Francis runner which comprises a crown, a band and blades, extending between this crown and this band, these blades defining liquid flow channels therebetween. This runner is characterized in that the ratio of the maximum thickness of each blade to the average developed length of the average fibre thereof is included between 0.1 and 0.2, while, at the level of the leading edge of this blade, the average fibre is oriented, over essentially the entire height of the leading edge, along a straight line which forms an angle (α) greater than 90° in relation to the linear speed of advance of the leading edge of the blade.

Thanks to the invention, the combination of the particular orientation of the leading edge and of the maximum thickness of the blades allows functioning without creating detrimental eddies or phenomena of cavitation.

According to other advantageous aspects of the invention, this runner incorporates one or more of the following characteristics:

The angle α has an average value over the height of the edge 21 included between 110° and 140°, preferably with a maximum value less than 150°.

The configuration shown in Figure 2 is that which prevails over essentially the entire height of the leading edge 21 between its point of attachment on the crown 3 and its point of attachment 214 on the band 4.

In other words, at the level of the leading edge 21, the average fibre 23 oriented from the trailing edge 22 towards the leading edge 21 extends in the direction of the straight line Δ_{23} which, with respect to a radius R_{21} of the runner 1 passing through the leading edge 21, is opposite the linear speed U of advance of the edge 21. In Figure 3, one passes therefore from the radius R_{21} to the straight line Δ_{23} by a rotation R in the inverse trigonometric direction. If the runner rotate in inverse direction, i.e. in the inverse trigonometric direction, the aforementioned geometrical distribution is inverted. Thus, with an incident speed V of the water jet similar to that envisaged for the turbine of the prior art and while this jet is oriented in the same direction, there may be obtained, with a relatively low linear speed U of the edge 21, a direction of incidence of the water jet on the leading edge 21 aligned with the straight line Δ_{23}, as figured by arrow W which represents, in Figure 3, the speed of the incident jet in the referential system of the leading edge.

The relatively great thickness e of the blade 2 is such that, on its lower surface 24, there is little risk of creation of eddies.

As shown in Figure 4, and taking into account its relatively great thickness e, a blade 2 is made with a metallic skin 26 surrounding a hollow volume V_2, this allowing an appreciable saving in weight and matter with respect to the case of the blade 2 being provided

CLAIMS

1. Francis runner which comprises a crown, a band and blades extending between said crown and said band, said blades defining liquid flow channels therebetween, characterized in that the ratio (e/L) of the maximum thickness (e) of each blade to the average developed length (L) of its average fibre (23) is included between 0.1 and 0.2, and in that, at the level of the leading edge (21) of each blade, said average fibre is oriented, over essentially the entire height of the leading edge, along a straight line (Δ_{23}) forming an angle (α) greater than 90° in relation to the linear speed of advance (U) of said leading edge.

2. Runner according to Claim 1, characterized in that said ratio (e/L) is greater than 0.13, preferably than 0.15.

3. Runner according to one of the preceding Claims, characterized in that the average angle (α) between the linear speed of advance (U) of a blade (2) at the level of its leading edge (21) and the average fibre (23) of said blade at the level of said leading edge is included between 110° and 140°.

4. Runner according to one of the pre ceding Claims, characterized in that each blade (2) is formed by a skin (26) constituting the two lateral faces (24, 25) of said blade and defining a hollow internal volume (V_2) of said blade.

5. Runner according to Claim 4, characterized in that said skin (26) is metallic.

6. Runner according to Claim 4, characterized in that said skin (26) is made of composite material.